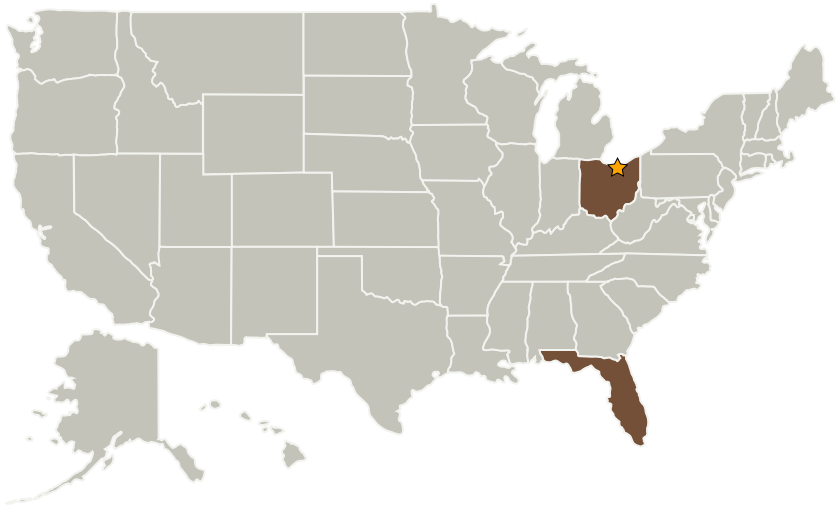
Development and Evaluation of Mixed Uranium-Refractory Carbide/Refractory Carbide Cer-Cer Fuels, Phase I

Completed Technology Project (2006 - 2006)

Project Introduction

A new carbon-based fuel is introduced with outstanding potential to eliminate the loss of uranium, minimize the loss of carbon, and retain fission products for many hours of operation in hydrogen environment at temperatures in excess of 3,200K. The proposed fuel is a Cer-Cer made of mixed uranium-refractory carbide particles such as (U, Zr)C or (U, Zr, Nb)C dispersed in a refractory carbide matrix such as ZrC. For efficient operation in NTR applications for Isp of 1000 sec. or more, a fuel temperature of 3000 K or greater is necessary. Various fuel materials have been tested for NTR applications with most based on carbide fuel technology because of their improved thermal properties enabling the design of very small, high power density cores. Fuel designs from dispersed microspheres in graphite, to composite mixed carbides with graphite, to solid solution mixed carbides have been tested. Fuels bearing graphite are not tenable because of the high reactivity of free carbon with the hot hydrogen propellant. Solid solution, mixed carbides are most often brittle but otherwise perform well under the high temperature flowing hot hydrogen environment. The life limiting phenomenon for their use in NTR applications is the loss of uranium due to vaporization from the fuel surface at temperatures in excess of 2800 K. Though the proposed Cer-Cer fuel is relatively at lower level of technology maturity, its unique potential for elimination of uranium loss and retention of fission fragments at very high operational temperatures would amply justify the proposed research program.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
New Era Technology	Supporting Organization	Industry	Gainesville, Florida

Primary U.S. Work Locations	
Florida	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.12 Alternative Low Carbon Jet Fuel